

Comparisons between motor performance and opportunities for motor stimulation in the home environment of infants from the North and Southwest regions in Brazil

Comparações entre o desempenho motor e oportunidades de estimulação motora no ambiente domiciliar de lactentes residentes nas regiões Sudeste e Norte do Brasil

Comparaciones del desempeño motor y oportunidades de estimulación motora en el entorno del hogar de lactantes moradores en las regiones Sureste y Norte de Brasil

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ABSTRACT | This study aimed at comparing the relationships between motor development and the characteristics in the home environment (physical space, daily activities, toys) of infants in two Brazilian regions, North (Marabá, PA) and Southeast (Piracicaba, SP). Alberta Infant Motor Scale (AIMS) was used to analyze motor development, and Affordances in the Home Environment for Motor Development – Infant Scale (AHEMD-IS) was used in order to analyze the family environments of eight breastfed babies of 3 to 18 months of age. The groups in the two municipalities were not different in regards to motor development ($p < 0.05$); however, significant differences were found among groups concerning day care frequency, fatherly schooling, and number of rooms in households. The results also indicated significant differences for opportunities at home, with the group from Marabá receiving significantly lower scores for the most part of the AHEMD-IS: external space ($p = 0.021$), toys for fine motor skills ($p < 0.001$), and total AHEMD-IS score ($p = 0.002$). No differences were found among groups in daily activities and the internal space of homes. Motor development and opportunities in the home environment (total AHEMD-IS) were found to have weaker correlations for both the group from Marabá ($r = 0.33$; $p = 0.03$) and the group from Piracicaba ($r = 0.45$; $p < 0.001$). In summary, although both

groups had similar motor development levels, the group of infants from Marabá was found to have fewer affordances (opportunities for action) as compared to the ones living in Piracicaba, which may result in differences in the motor development of the groups in the future.

Keywords | Infant; Environment; Child Development.

RESUMO | A proposta deste estudo foi comparar as relações entre o desempenho motor e as características do ambiente familiar (espaço físico, atividades diárias, brinquedos) de lactentes residentes em duas regiões do Brasil, Norte (Marabá, PA) e Sudeste (Piracicaba, SP). Foram utilizados a Alberta Infant Motor Scale (AIMS) para a análise do desempenho motor e o Affordances in the Home Environment for Motor Development – Infant Scale (AHEMD-IS) para a análise do ambiente familiar em oitenta lactentes de 3 a 18 meses de idade. Os grupos dos dois municípios não diferiram quanto ao desempenho motor ($p > 0,05$), porém, foram encontradas diferenças significativas entre os grupos no que se refere à frequência em creches, à escolaridade paterna e ao número de quartos nas residências. Os resultados também indicaram diferenças significativas para as oportunidades no lar, com o grupo de Marabá obtendo pontuações significativamente menores na maior parte do AHEMD-IS: espaço externo

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($p=0,021$), brinquedos para motricidade fina ($p<0,001$) e grossa ($p<0,001$), e o escore total do AHEMD-IS ($p=0,002$). Não foram encontradas diferenças entre os grupos nas atividades diárias e no espaço interno da residência. O desempenho motor e as oportunidades no ambiente domiciliar (total do AHEMD-IS) demonstraram uma correlação fraca tanto para o grupo de Marabá ($r=0,33$; $p=0,03$) quanto para o grupo de Piracicaba ($r=0,45$; $p<0,001$). Em conclusão, apesar dos grupos apresentarem níveis de desenvolvimento motor similares, o grupo de lactentes em Marabá apresentou menos affordances (oportunidades de ação) comparados aos residentes de Piracicaba, o que, no futuro, pode resultar em diferenças no desempenho motor dos grupos.

Descritores | Lactente; Meio Ambiente; Desenvolvimento Infantil.

RESUMEN | En este estudio tuvo el propósito de comparar las relaciones entre el desempeño motor y las características del entorno del hogar (el espacio físico, las actividades diarias, los juguetes) de lactantes moradores en dos regiones de Brasil, el Norte (Marabá, PA) y el Sureste (Piracicaba, SP). Se utilizaron el Alberta Infant Motor Scale (AIMS) para el desempeño motor y el Affordances in the Home Environment for Motor Development – Infant Scale (AHEMD-IS) para el análisis del entorno del hogar

en ochenta lactantes de 3 hasta 18 meses de edad. Los grupos de los dos municipios no presentaron diferencias significativas en relación al desempeño motor ($p>0,05$), sin embargo, se encontraron diferencias significativas en lo que se refiere a la asistencia a guardería, al nivel de educación del padre y al número de habitaciones en sus casas. Los resultados también mostraron diferencias significativas en las oportunidades en los hogares, el grupo de Marabá obtuvo puntuaciones significativamente menores en la mayor parte del AHEMD-IS: espacio externo ($p=0,021$), juguetes para habilidades motoras finas ($p<0,001$) y gruesas ($p<0,001$), y el escore total del AHEMD-IS ($p=0,002$). En cuanto a las actividades diarias y al espacio interno de las casas no se encontraron diferencias. El desempeño motor y las oportunidades en el entorno del hogar (total del AHEMD-IS) mostraron una correlación baja tanto para el grupo del Marabá ($r=0,33$; $p=0,03$) como para el de Piracicaba ($r=0,45$; $p<0,001$). Aunque los grupos presentaron niveles semejantes de desarrollo motor, se concluyó que el grupo de lactantes de Marabá presentó menos affordances (oportunidades de acción) que el de Piracicaba, lo que puede resultar en diferencias para su futuro en relación al desempeño motor de los grupos.

Palabras clave | Lactante; Ambiente; Desarrollo Infantil.

INTRODUCTION

Brazil is a country which is characterized by regional differences which arise from culture contexts and specialized resources, which represents each geographical region. The inequalities between northern and southeastern regions in Brazil are shown in indicators such as the human development index (HDI), education, life expectancy, per capita income, poverty, and in Brazil's gross domestic product (GDP)¹⁻³. Although those differences are very famous, little is known as to how much they affect the motor development in early childhood, and to which extent they influence the opportunities for actions and events (affordances) in the family environments of breastfed babies. To Unesco, the quality in the family environment over the first few years of life is a critical indicator in childhood development, and it can be used as a direct measure for development⁴.

The first year of life is characterized by important changes in motor behavior; however, the specificities of that path and the ways through which breastfed babies move depend on their cultural and environmental

context⁵. Inside that context, we may point out the influence of the number and diversity of opportunities (stimuli) in the home environment, which are specific for the motor development of breastfed babies. Recently, a specific instrument to evaluate those opportunities in the home environment was created and validated in the USA and in Brazil, with a focus on understanding the internal and external spaces of daily activities and toys which are available for breastfed babies between 3 and 18 months of age⁶. That instrument is called Affordances in the Home Environment for Motor Development – Infant Scale (AHEMD-IS), which is known in Brazil as AHEMD - Escala Bebê (Baby Scale). Some studies using that instrument have found, for example, that the motor development opportunities in the home environment are as important as the biological development factors⁷, and they also have a positive impact in breastfed babies' future motor and cognitive development⁸.

In Brazil, the cultural and socioeconomic differences are very famous^{1,2}, but little is known in regards to their repercussions in child development. Thus, this study aimed at comparing the relationships between

motor development and the characteristics in the home environment (physical space, daily activities, toys) of typical breastfed babies in two Brazilian regions, North (Marabá, PA) and Southeast (Piracicaba, SP). Due to the influences from cultural, environmental, and socioeconomic differences in the motor development of breastfed babies in Brazil and other countries^{9,10}, and this study is expected to show differentiated interactions among opportunities in the home environment and motor development for each subject in investigated Brazilian regions.

METHODOLOGY

Sample

Exploratory study, with a transverse design and quantitative approach. The sample comprised typical breastfed babies (with not neurological alterations, genetic syndromes, or congenital malformations) of 3 to 18 months of age, which lived in Marabá (PA), northern region (n=40, 21 females and 19 males) and in Piracicaba (SP) southeastern region, (n=40, 20 females and 20 males) of Brazil. Conducting studies comparing faraway regions in a country with large continental regions such as Brazil is a great challenge. Both of them were medium-sized municipalities (populations between 100 thousand and 500 thousand inhabitants); Piracicaba was chosen as it is the location where the host university of the study is in, and Marabá was chosen due to the fact it is the location where the first author teaches at.

Table 1. Studied locations and their characteristics

| Characteristics | Piracicaba - SP | Marabá - PA |
|---|----------------------------|---------------------------|
| Geographical location | Southeastern Region | Northern Region |
| Population | 364,571 inhabitants | 233,669 inhabitants |
| Population density | 264.47 hab/km ² | 15.45 hab/km ² |
| IDH-M 2010* | 0.785 | 0.668 |
| MHDI - Education index | 0.717 | 0.564 |
| MHDI - Longevity index | 0.848 | 0.785 |
| MHDI - Income index | 0.797 | 0.673 |
| Per capita monthly household income (R\$) | 946.00 | 463.00 |
| GDP based on current prices (R\$) | 10,927,808 | 3,562,534 |
| Per capita GDP based on current prices - 2012 (R\$) | 32,135.11 | 18,159.27 |
| Poverty index | 15.24% | 42.73% |

*Municipal Human Development Index (M-HDI) of the United Nations Development Program (UNDP). Sources: IBGE - Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics), (2010). Available on: <http://www.ibge.gov.br/cidadesat/> Atlas of Human Development in Brazil 2013 (With data from 1991, 2000, and 2010 Censuses). Available on: <http://www.pnud.org.br/atlas/ranking/Ranking-IDHM-Municipios-2010.aspx>

The research was approved by the Ethics Committee of Universidade Metodista de Piracicaba (procedure no. 29/08). The data which characterize both study locations are described in Table 1.

Instruments

The opportunities for motor development in the home environment were evaluated through the Brazilian version of questionnaire “Affordances in the home environment for motor development – Infant Scale (AHEMD-IS)”⁶, a self-evaluation and self-explanatory questionnaire focused on the fathers of breastfed babies of ages between 3 and 18 months. This instrument is based on the premise from the ecological theory which sees the concept of affordances as opportunities providing the potential for action¹¹. It comprises a section about the breastfed baby’s characteristics and family (15 questions); characteristics and dimensions of the internal and external physical spaces (10 questions), daily activities (11 questions), and materials and toys which provide opportunities for the breastfed baby’s fine and gross motor skills (20 questions). It uses three types of questions: dichotomous (yes/no), Likert-type (four answer levels), and descriptive questions using illustrations as examples for the different types of toys. In the study, the scores obtained in AHEMD-IS questionnaire were analyzed as a whole and in each of its five dimensions, based on the score that was used in the first study which presented AHEMD-IS (for the full explanation please refer to Caçola et al.⁶).

Alberta Infant Motor Scale (AIMS)¹² was used to evaluate motor development. That is an observational scale which requires minimum handling and allows evaluating gross motor development and posture control from birth to independent gait acquisition or to 18 months of age. The scale comprises 58 items which illustrate the sequence of posture control development in four positions: prone (21 items), supine (9 items), sitting (12 items), and standing (16 items). At the end of the evaluation, a total score ranging from zero to 58 points is obtained. The total score and the breastfed baby’s age are plotted in a development curve which ranges between percentiles 5 and 90. The higher the percentile, the lesser the chances for delayed motor development, and the opposite also applies: the lower the percentile, the higher the chances for delayed motor development.

When families finished answering AHEMD-IS questionnaire, motor development evaluation was started. The motor evaluation was conducted by the main researcher in both cities. On the occasion, the breastfed babies had no clothes on or wore diapers; they were left free in their home environments, moving spontaneously and going through the four positions (prone, supine, sitting, and standing) required by AIMS. When a breastfed baby's behavior did not safely reflect its skill, concerning behaviors of crying, feeling sleepy, or hungry, evaluations were interrupted and rescheduled to up to seven days to be finished.

Statistical analysis

The groups to which breastfed babies and families belonged to (either Piracicaba or Marabá) were considered as independent variables. Breastfed babies motor development and its opportunities for motor development in the home environment were considered as dependent variables. The data were processed through Statistical Package for Social Sciences for Personal Computer (SPSS/PC version 11.0). Mann-Whitney U test was used to compare the groups in regards to motor development and to the opportunities, and Spearman's rank correlation coefficient, in turn, was used to investigate the relationships between motor development and the motor development opportunities (total AHEMD-IS score), with a 5% significance level.

RESULTS

The groups were not found to have statistically significant differences in regards to chronological or adjusted ages for prematurity, gender, birth weight classification, prematurity (gestational age), and Apgar score. There were no differences either in regards to family characteristics such as: schooling of mothers ($p=0.315$), number of adults ($p=0.144$) and children ($p=0.459$) in the households, type of household ($p=0.132$), and the fact of a mother being the main caregiver ($p=0.063$). However, significant differences were found between the groups in regards to the following family characteristics: attending day care facilities ($p=0.004$), fatherly schooling ($p=0.001$), and number of rooms in the households ($p=0.030$).

The breastfed baby groups of both municipalities were not found to be different in regards to motor

development ($p=0.678$); however, the results exhibited differences for home opportunities, the group from Marabá (PA) obtaining significantly lower scores in motor development opportunities for almost all dimensions, except for dimensions daily activities ($p=0.782$) and internal household space ($p=0.170$), as compared to the group from Piracicaba. Groups were found to have a significant difference in their total AHEMD-IS scores (Marabá: 32.31; Piracicaba: 48.69, $p=0.002$) in regards to the external household space (Marabá: 34.68; Piracicaba: 46.33, $p=0.021$), as well as the type of toys for fine (Marabá: 31.36; Piracicaba: 49.64, $p<0.001$) and gross motor skills (Marabá: 30.70; Piracicaba: 50.30, $p<0.001$).

In regards to the association between motor development and opportunities in the home environment (total AHEMD-IS score), in the two municipalities, weak correlations ($r=0.33$; $p=0.03$) were found for the groups of breastfed babies from Marabá and Piracicaba ($r=0.45$; $p<0.001$). Table 2 shows the correlation values with all AHEMD-IS dimensions and AIMS scores by municipality.

Table 2. Correlation between a breastfed baby's motor development and the motor development opportunities at home in Marabá (PA) and Piracicaba (SP)

| | AIMS (Marabá) | AIMS (Piracicaba) |
|--------------------------------------|------------------------|------------------------|
| External space | $r=0.19$ $p=0.21$ | $r=-0.12$ $p=0.42$ |
| Internal space | $r=0.18$ $p=0.91$ | $r=0.09$ $p=0.58$ |
| Internal and external spaces | $r=0.16$ $p=0.30$ | $r=0.05$ $p=0.73$ |
| Daily activities | $r=0.28$ $p=0.07$ | $r=0.45$ $p=0.00^*$ |
| Toys for gross motor skills | $r=0.29$ $p=0.06$ | $r=0.13$ $p=0.40$ |
| Toys for fine motor skills | $r=0.11$ $p=0.48$ | $r=0.19$ $p=0.22$ |
| Toys for fine and gross motor skills | $r=0.20$ $p=0.20$ | $r=0.21$ $p=0.19$ |
| AHEMD-IS score | $r=0.33$ $p=0.03^*$ | $r=0.30$ $p=0.05$ |

r = Spearman's rank correlation coefficient; $n=40$; *Significant correlation with $p<0.05$.

DISCUSSION

The aim of this study was to understand the interactions between opportunities in the home environment and motor development, considering two municipalities which represent distinct regions in Brazil: Marabá municipality, in Pará state, representing

North region, and Piracicaba municipality, in São Paulo state, representing Brazil's Southeast. The results show that the groups have not differed in regards to their motor developments, but they were different concerning the opportunities for motor development in the home environment, with breastfed babies from Marabá having a significantly lower number of opportunities/affordances than the group of breastfed babies which lived in Piracicaba. However, in both groups, a weak correlation was found to exist between home opportunities and motor development.

Motor development assessment through AIMS scale showed that groups were not different in regards to motor development. That finding is based on the understanding that motor development is the result from the integration of several domains: sensory-motor, cognitive, and social-emotional. Those domains are, in turn, influenced by genetic inheritance, biological and socioenvironmental factors, and they may be affected by adverse or favorable situations, thus their results cannot be totally predicted^{11,13}. Groups were not found either to differ in regards to family characteristics such as the schooling of mothers or the number of adults and children in the households, which goes against the expected differences, once the groups are culturally and geographically different. Such factor may be justified through the high number of migrants who are attracted by the regional economic wealth (Marabá), which could result in modified cultural habits and practices. However, almost all families of studied breastfed babies in Marabá came from a single neighborhood, whose houses were made of wood and were similar to stilt houses. They were located in an encroached area that is characterized by poor infrastructure conditions, such as dirt streets, lack of basic sanitation services, and poverty conditions.

However, significant differences were shown between groups concerning the following characteristics: breastfed babies attending day care facilities, fatherly schooling, and number of rooms in the households. The similarities indicate relative homogeneity in the characteristics of families, with the schooling of mothers standing out. That finding¹⁴ shows a trend to the higher schooling of mothers as compared to fathers, regardless of the economic levels, which may be a factor that influences the acquisition of motor skills^{9,15}.

In regards to home opportunities, it is important to point out that no differences were observed in the municipalities concerning daily activities. In

AHEMD-IS, that dimension specifically refers to the varied stimulation means that are offered in the home environment, which does not depend on owning equipment or toys. Even though the breastfed babies from Marabá have less home opportunities, the daily activities which do not depend on the socioeconomic levels of families were not affected¹⁶. From those findings, it is possible to suggest that, the same way the socioeconomic status is related to the acquisition of toys and the physical space in the home environment, the interaction between parents and breastfed babies is related to daily activities.

Despite the lack of differences in motor development for both groups, it is important to warn that environmental and cultural differences may also influence motor development between ages 3 and 18 months, considering that it is a period of dramatic changes in the reciprocal interaction between a breastfed baby's motor possibilities and the stimuli that are provided by its family⁸. In the same study, the environmental impact in the motor and cognitive development of babies was found to increase with age, which shows that home environments significantly influenced the fine motor development of breastfed babies, and that is related to cognitive skills⁸. Those results point towards the fact that motor development and its relationship with home opportunities are continuous, and it is possible that the groups are differentiated by their motor developments⁸ in the future, as a consequence from the different opportunities between the two studied municipalities.

One of the limitations in this study was due to its probability sampling and to the fact it was conducted in a transverse fashion. Longitudinal supervision could contribute to understand the relationships, with time, between motor development and the characteristics in the home environment (physical space, daily activities, and toys) in a perspective comparing cultures in Brazil. As the country is very large and socioeconomically and culturally diverse concerning its regions, it is understood that research must be conducted in less developed centers, as well as in less favored regions, involving the relationship between opportunities from typical breastfed babies and the possible influences on motor development.

This study brings important contributions to physical therapy, as its results point towards repercussion from the environment in the motor development of both groups, which indicates a need for including the evaluation of family environment

aspects in the clinical practice¹⁷. In the physical therapy practice, the importance of instructions stand out in regards to the home activities which complement treatments, which, in general, involve the use of spaces, toys, and moments for care and playfulness in the daily routing of breastfed babies and their families. In the clinical practice, the inclusion of evaluation instruments in home environments (as proposed by AHEMD-IS) may contribute to guide the home instructions to the conditions in the environment, thus focusing on motor development stimulation aspects which lack reinforcement.

It is possible to conclude that living in distinct Brazilian regions, such as the North and the Southeast, does not lead to immediate impacts in the motor development of breastfed babies. However, studied home environments in the northern region are less privileged in regards to motor development opportunities, specifically in relation to external physical spaces and number and variety of available toys. The findings also suggest some influence from the environment in the motor developments of both groups. For the ones living in the northern region, the relationship that was found was with global opportunities for motor development (total AHEMD-IS score), and the babies residing in the southeastern region, in turn, such relationship was with the dimension of daily activities in AHEMD-IS. In a certain way, it is possible that the discrepancy in home opportunities results in future differences in the motor development of the breastfed babies.

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